CLAIMS

We claim:

1. A method of depositing silicon dioxide over a semiconductor substrate, comprising the acts of:

using oxygen and silane gases to deposit silicon dioxide over the substrate;

using ions to etch a portion of the deposited silicon dioxide during the deposition; and

controlling the etch and the deposition of the silicon dioxide such that an etch to deposition ratio is 0.07 or less.

2. The method of claim 1 further comprising controlling the deposition and the etch such that the etch to deposition ratio is 0.025 or less.

3. The method of claim 1 further comprising using an oxygen to silane ratio of 1.3 or less.

4. The method of claim 1 further comprising using a total gas flow of the oxygen, the silane, and an inert gas of 625 standard cubic centimeters per minute or less,

5. The method of claim 1 further comprising using a total gas flow of the oxygen, the silane, and an inert gas of 500 standard cubic centimeters per minute or less.

6. The method of claim 1 further comprising using a high frequency bias signal power of 2000 watts or less.

7. The method of claim 1 further comprising using a high frequency bias signal power of 1500 watts or less.

8. The method of claim 1 further comprising the act of doping the silicon dioxide during deposition.

9. The method of claim 1 further comprising the act of depositing the silicon dioxide over an electrically conductive layer used as an interconnect.

10. The method of claim 9, wherein the electrically conductive layer is metal.

11. The method of claim 1 further comprising the acts of:

depositing the silicon dioxide over a layer of silicon nitride, the silicon nitride being formed over a layer of polycrystalline silicon;

polishing the silicon dioxide to expose a top surface of the silicon nitride; and

etching the silicon dioxide such that a top surface of the etched silicon dioxide is below a top surface of the layer of polycrystalline silicon.

12. An integrated circuit structure comprising silicon dioxide formed in a trench, the silicon dioxide being deposited by acts comprising:

using oxygen and silane gases to deposit the silicon dioxide;

using ions to etch a portion of the deposited silicon dioxide; and

controlling the etch and the deposition of the silicon dioxide such that an etch to deposition ratio is 0.07 or less.

13. The integrated circuit of claim 12, wherein the etch to deposition ratio is 0.025 or less.

14. The integrated circuit of claim 12, wherein using oxygen and silane gases comprises using an oxygen to silane ratio of 1.3 or less.

15. The integrated circuit of claim 12, wherein using oxygen and silane gasses comprises using a total gas flow rate of the oxygen, the silane, and an inert gas, the total gas flow rate being 625 standard cubic centimeters per minute or less.

16. The integrated circuit of claim 12, wherein using oxygen and silane gasses comprises using a total gas flow rate of the oxygen, the silane, and an inert gas, the total gas flow rate being 500 standard cubic centimeters per minute or less.

17. The integrated circuit of claim 12, wherein the silicon dioxide is deposited using a high frequency bias signal power of 2000 watts or less.

18. The integrated circuit of claim 12, wherein the silicon dioxide is deposited using a high frequency bias signal power of 1500 watts or less.

19. A method of depositing silicon dioxide over a semiconductor substrate, comprising the acts of:

using silane gas, oxygen gas, and an inert gas to deposit the silicon dioxide, wherein a ratio of oxygen to silane is 1.7 or less, and wherein the total flow rate of the silane, oxygen, and inert gasses is 500 standard cubic centimeters per minute or more; and

using a bias signal to concurrently sputter etch a portion of the deposited silicon dioxide.

20. The method of claim 19, wherein the ratio of oxygen to silane is 1.3 or less.

21. The method of claim 19, wherein the signal has a power of 2000 watts or less.

22. The method of claim 19, wherein the signal has a power of 1500 watts or less.

23. The method of claim 19, wherein a total flow rate of the silane, oxygen, and inert gasses is 625 standard cubic centimeters per minute or more.

24. An integrated circuit structure comprising silicon dioxide formed in a trench, the silicon dioxide being deposited by acts comprising:

using silane gas, oxygen gas, and an inert gas to deposit the silicon dioxide, wherein a ratio of oxygen to silane is 1.7 or less, and wherein the total flow rate of the silane, oxygen, and inert gasses is 500 standard cubic centimeters per minute or more; and

using a bias signal to concurrently sputter etch a portion of the deposited silicon dioxide.

25. The integrated circuit of claim 24, wherein the ratio of oxygen to silane is 1.3 or less.

26. The integrated circuit of claim 24, wherein the signal has a power of 2000 watts or less.

27. The integrated circuit of claim 24, wherein the signal has a power of 1500 watts or less.

28. The integrated circuit of claim 24, wherein a total flow rate of the silane, oxygen, and inert gasses is 625 standard cubic centimeters per minute or more.

29. A method of depositing silicon dioxide over a semiconductor substrate, comprising the acts of:

using silane gas, oxygen gas, and helium gas to deposit the silicon dioxide, wherein a ratio of oxygen to silane is 1.7 or less; and

using a bias signal to concurrently sputter etch a portion of the deposited silicon dioxide.

30. The method of claim 29, wherein the ratio of oxygen to silane is 1.3 or less.

31. The method of claim 29, wherein the signal has a power of 2000 watts or less.

32. The method of claim 29, wherein the signal has a power of 1500 watts or less.

33. The method of claim 29, wherein a total flow rate of the silane, oxygen, and helium gasses is 625 standard cubic centimeters per minute or less.

34. The method of claim 29, wherein the total flow rate is 500 standard cubic centimeters per minute or less.

35. An integrated circuit structure comprising silicon dioxide formed in a trench, the silicon dioxide being deposited by acts comprising:

using silane gas, oxygen gas, and helium gas to deposit the silicon dioxide, wherein a ratio of oxygen to silane is 1.7 or less; and

using a bias signal to concurrently sputter etch a portion of the deposited silicon dioxide.

36. The method of claim 35, wherein the ratio of oxygen to silane is 1.3 or less.

37. The method of claim 35, wherein the signal has a power of 2000 watts or less.

38. The method of claim 35, wherein the signal has a power of 1500 watts or less.

39. The method of claim 35, wherein a total flow rate of the silane, oxygen, and helium gasses is 625 standard cubic centimeters per minute or less.

40. The method of claim 35, wherein the total flow rate is 500 standard cubic centimeters per minute or less.